

Remarks

Applicant has filed a Request for Continued Examination and this Amendment in response to the Office Action dated July 8, 2004. Claims 24, 40, 44 and 60 have been amended. Claims 1-19, 27-39, 57-59 and 62 have been canceled without prejudice. New claims 63-67 have been added. Claims 20-26, 40-56, 60-61 and 63-67 are currently pending. Reexamination and reconsideration are respectfully requested.

Applicant thanks the Examiner for the interview conducted on Aug. 20, 2004, in which the rejections and the cited art to Li, Horita, Chuang and Wang were discussed. Claims 24, 40, 44 and 60 were discussed in view of the cited art. Agreement was not reached but the Examiner stated that he would further consider applicant's remarks and amendments.

Claims 1-19, 27-31, 57-59 and 62 have been previously canceled without prejudice to further prosecute these claims at a later date. In this Amendment, claims 32-39 have also been canceled without prejudice to further prosecute these claims at a later date.

Claims 20-25, were rejected under 35 U.S.C. 103(a) as unpatentable over U.S. Patent No. 6,064,105 to Li et al. ("Li") in view of U.S. Patent No. 6,303,432 to Horita et al. ("Horita") and U.S. Patent No. 6,548,373 to Chuang et al. ("Chuang"). The rejection is respectfully traversed.

To establish a prima facie case of obviousness, there should be a suggestion or motivation in the art to modify the reference or to combine reference teachings, there should be a reasonable expectation of success, and the reference(s) must teach all the claim limitations. MPEP section 706.02(j). Applicant respectfully submits that the Examiner has not met his burden to establish a prima facie case of obviousness.

Applicant respectfully submits that the Examiner's citations to the art do not describe or suggest a method having all of the elements of claim 24, as amended, including "removing the pad layer and exposing the first layer, after the removing the polishing stopper layer" and "forming a sacrificial oxide layer in direct contact with the first layer, after the removing the pad layer." Regarding independent claim 24, the Examiner stated at page 3 of the Office Action that Li describes "removing the pad layer (114) after the [re]moving the polishing stopper layer (116); forming a sacrificial oxide layer (136) on the first layer (112) after the removing the pad layer (114); . . ." Applicant respectfully submits that the Examiner's statement is not supported by his citation to the art. For example, as described at col. 5, lines 7-10, Li recites that "[t]he thickness

of the sacrificial oxide layer is approximately 200Å, which is added to the thickness of the barrier oxide layer 114." Thus, the barrier oxide layer 114 still remains when the sacrificial oxide layer 136 is formed. Accordingly, the Examiner's citation to Li does not describe "removing the pad layer and exposing the first layer, after the removing the polishing stopper layer" and "forming a sacrificial oxide layer in direct contact with the first layer after the removing the pad layer" as recited in claim 24.

The Examiner's comments relating to Horita and Chuang do not appear to overcome the deficiency of Li as described above. Accordingly, for at least the above reasons, applicant respectfully submits that the rejection of claim 24 should be withdrawn.

For at least the above reasons, applicant respectfully submits that the Examiner's citations to the art do not teach all the claim limitations and accordingly, the rejection of claim 24 should be withdrawn.

Claims 20-23 and 25 depend from claim 24 and the rejection of these claims should be withdrawn for at least the same reasons as claim 24.

Claim 26 was rejected over Li, Horita and Chuang and further in view of U.S. Patent No. 6,165,854 to Wu ("Wu"). The rejection is respectfully traversed. Claim 26 depends from claim 24. Accordingly, for at least the above reasons, applicant respectfully requests that the rejection of claim 26 be withdrawn.

Claims 32-39 have been canceled without prejudice to further prosecute these claims if desired.

Claims 40-49, 51-56, and 60-62 were rejected under 35 U.S.C. 103(a) as unpatentable over Li in view of U.S. Patent No. 6,087,243 to Wang ("Wang") and Horita. The rejection is respectfully traversed. Claim 40 has been amended for clarity and claim 44 amended to insert the word "and" on line 16. Applicant respectfully submits that the Examiner has not met his burden to establish obviousness.

The Examiner appears on page 9 of the Office Action to have cited Wang as relating to thermally treating a trench dielectric layer after removing the polishing stopper layer. Wang at col. 6, lines 53-60, recites the following:

Silicon nitride layer 13 is then removed leaving a pad oxide layer of about 100 Å to about 300 Å, typically about 150Å. Retrograde well implants are

then formed, as by ion implantation. Heating is then conducted . . . during which the oxide trench fill is densified and the retrograde implants activated to form retrograde wells . . .

Thus it appears that the thermal treatment the Examiner is citing takes place after forming retrograde implants by ion implantation. Moreover, the thermal treatment of Wang also serves to activate the implants.

The Examiner then on page 10 of the Office Action cited Horita for "forming a well after the thermally treating the dielectric layer" (column 9, lines 9-16). Horita at col, 9, lines 14-16, states that "[A]fter formation of the thermal oxide film, the channel implanted layer or the well is formed by means of ion implantation." However, it appears that the Examiner considers the forming of a thermal oxide film as set forth in Horita at col. 9, line 11 to be the "thermally treating the dielectric layer". Applicant notes that the Examiner cited no portion of Horita describing a temperature of forming the thermal oxide layer and as a result, the Examiner cited no portion of Horita that describes thermally treating the dielectric layer at a temperature "of at least 1050°C" as recited in claim 40.

Moreover, the Wang reference describes forming a well by ion implantation prior to performing a thermal treatment of the trench oxide, whereas Horita as cited by the Examiner describes as forming a well by ion implantation after performing a thermal treatment (to form an oxide layer). The Examiner cited no portion of the art that suggests that one of ordinary skill would change the order of the process of Wang as suggested by the Examiner. Indeed, Wang specifically notes that the heating performs the functions of both densifying the oxide trench fill and activating the implants. One of ordinary skill would have no reason to change the order of steps as suggested by the Examiner, as the heating would not then perform both functions set forth in Wang.

Accordingly, applicant respectfully submits that for at least the reasons stated above, the Examiner has not met the proper burden to establish obviousness and as a result, the rejection of claim 40 and its dependent claims 41-43, 47-49 and 51-56 should be withdrawn.

Regarding claims 44-46, applicant respectfully submits that the Examiner cited no portion of the art that describes or suggests a method including "isotropically etching the pad layer and upper portions of the dielectric layer after the removing the polishing stopper layer and prior to

the conducting the thermal treatment, wherein the isotropically etching exposes upper surfaces of the semiconductor layer" as recited in claim 44. The Examiner stated on page 11 of the Office Action that the "combined device further shows an oxide layer (Li et al.; 122) is formed on the exposed upper surfaces of the semiconductor layer (Li et al.; 112) . . ." Instead, it appears that the upper surfaces of the semiconductor layer as cited by the Examiner are not exposed as recited in claim 44.

For example, the Examiner's citation to Wang appears to describe a method in which the upper surfaces of the dielectric layer are not exposed prior to the conducting the thermal treatment as recited in claim 44. Specifically, Wang at col. 6, lines 53-57, recites that "[s]ilicon nitride layer 13 is then removed leaving a pad oxide layer of about 100A to 300A, Retrograde well implants are then formed, as by ion implantation. Heating is then conducted at a first temperature of about 900°C. to about 1100°C. . . ." Thus, it appears that Wang teaches "leaving a pad oxide layer of about 100A to 300A," which means that the semiconductor layer is not exposed. Li, as cited by the Examiner, appears to describe a method including similar steps to those of Wang. For example, Li, at col. 4, lines 58-60, recites that "[a]fter the polishing step, the nitride layer 116 is stripped away by etching and a photoresist layer 14 is applied to the top surface of the barrier oxide layer 114 . . ." Thus, the etching at this stage of the Li process does not appear to including exposing the semiconductor upper surfaces as recited in claim 44.

Accordingly, the cited art appears to teach away from the process recited in claim 44. In addition, applicant respectfully submits that the art would not be combined as suggested by the Examiner for reasons similar to those set forth above for claim 40. As a result, applicant respectfully requests that the rejection of claim 44 and its dependent claims 45-46 be withdrawn.

For claim 60, applicant notes that the Examiner's citations to Li and Wang do not describe or suggest a method including "removing the polishing stopper layer and the pad oxide layer so that an upper surface of the semiconductor layer is exposed; and heating the dielectric layer to a temperature of at least 1050°C after the removing the polishing stopper layer and the pad oxide layer" as recited in claim 60, as amended. For the reason above and for similar reasons as described for claim 40, applicant respectfully requests that the rejection of claim 60 and its dependent claim 61 should be withdrawn.

Claim 50 was rejected under 35 U.S.C. 103(a) as unpatentable over Li in view of Wang and Horita and further in view of U.S. Patent No. 6,165,854 to Wu ("Wu"). The rejection is respectfully traversed. The Examiner cited no portion of Wu that overcomes the deficiencies of the combination of the other art as described above for claim 40, from which claim 50 depends. Accordingly, for at least the same reasons as described above for claim 40, applicant respectfully requests that the rejection of claim 50 be withdrawn.

In addition to the reasons stated earlier for claim 24 and its dependent claims, applicant respectfully submits that the Examiner has also not met his burden to establish a suggestion or motivation in the art to modify the reference or to combine the reference teachings as required according to MPEP section 706.02(j). The Examiner stated on page 3 of the Office Action that "it would have been obvious . . . to incorporate the teaching of Horita et al. into the method taught by Li et al. because it eliminates the contamination and recovers the polishing effect." However, the Examiner cited no portion of Li or Horita that describes the elimination of contamination and recovery of the polishing effect due to "forming a well after the thermally treating the dielectric layer." Accordingly, the Examiner has not established an adequate suggestion or motivation for the proposed combination of references. Thus, the rejection of claim 24 and its dependent claims 20-23 and 25 should also be withdrawn for this reason.

The Examiner also stated on pages 3-4 of the Office Action that "it would have been obvious . . . to incorporate the teaching of Chuang et al. into the method taught by Li et al. and Horita et al. because it reduces the damage of silicon layer." However, the Examiner cited no portion of the references that describes the reduction of damage to silicon due to thermally treating the dielectric layer. Accordingly, the Examiner has not established an adequate suggestion or motivation for the proposed combination of references. Thus, the rejection of claim 24 and its dependent claims 20-23 and 25 should also be withdrawn for this reason.

The Examiner also stated that for claim 25, "it would have been obvious . . . for thermally treating the dielectric layer is carried out in an atmosphere comprising 0.1 volume % to 10 volume % oxygen because it is densified the dielectric layer." However, the Examiner cited no art for this contention. Moreover, the Examiner also stated that "discovering an optimum value of a result effective variable involves only routine skill in the art." However, in this case the Examiner cited no general conditions from which one could find an optimum value. One

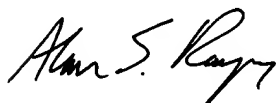
cannot discover an optimum value when no general conditions are cited in the art and here the Examiner cited no art having any general conditions relating the oxygen content. Thus, the rejection is claim 25 is deficient and should be also withdrawn for this reason. In addition, for claim 26 (which depends from claim 24), the Examiner's citation to Wu does not overcome all of the deficiencies described above relating to the proposed combination of the other references as cited by the Examiner and described above. Accordingly, the rejection of claim 26 should also be withdrawn for this reason.

New claims 63-67 have been added. Support for these claims may be found throughout the specification and original claims. Examination of these claims is respectfully requested.

The Office Action also included various comments concerning the art and the non-patentability of features in various of the pending claims. Applicant notes that the Examiner's comments in the Office Action that have not been specifically discussed above are deemed moot at this time in view of this response.

Applicant respectfully submits that the pending claims are in patentable form. Reexamination and reconsideration are respectfully requested. If, for any reason, the application is not in condition for allowance, the Examiner is requested to telephone the undersigned to discuss the steps necessary to place the application into condition for allowance.

Respectfully submitted,



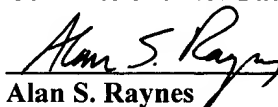
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Sept. 22, 2004
(Date)